OFFICIAL COMMENT

City of
Indianapolis
Bart Peterson, Mayor

June 28, 2002

#02-138 (WPCB) [Mercury Variance]
Mary Ann Stevens
Rules Section, Office of Water Quality
Indiana Department of Environmental Management
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015

SUBJECT: City of Indianapolis Comments on First Notice of Comment Period to Develop Statewide Mercury Variance Rule

Dear Ms. Stevens:

On June 1, 2002, the Indiana Department of Environmental Management ("IDEM") published a first notice of comment period in the Indiana Register to initiate a rulemaking to develop statewide variance procedures for the mercury water quality criteria. The City of Indianapolis (the City) provides these comments to assist IDEM in development of rule language for the second notice of comment period.

The City supports immediate rulemaking for establishing procedures and permit conditions specific to mercury variances and encourages IDEM to expedite the rulemaking process. The City believes a statewide process for issuing mercury variances from the chronic aquatic life criterion, applicable to waters outside the Great Lakes basin, of 12 ng/L (or ppt) and the wildlife criterion (1.3 ppt) and the human health criterion (1.8 ppt), applicable to waters inside the Great Lakes basin, is reasonable and technically defensible.

The City, in evaluating options to control mercury as part of an individual variance application,[1] has determined that further control of total mercury in our effluent comes at a cost to both the environment as well as the public. In addition, the controls identified are not proven to achieve water quality levels and any controls will require time (beyond an NPDES permit cycle) to be effective in reducing effluent mercury levels. The impact on resources to control mercury in water discharges is not unique to the City, but would be universal to any municipality. As a result, a process to obtain mercury variances by a rule, rather than by individual mercury variance applications, that recognizes the commonalties and state of knowledge on mercury sources, control options, and multimedia impacts, will allow more efficient and effective issuance of discharge permits.

[1] City of Indianapolis, "Supplement to June 1998 Application for a Variance from Indiana Water Quality Standards: Mercury – Acid-Soluble", submitted July 13, 2001.

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The City, in its individual variance application, identified the following issues relating to further control of mercury in its wastewater discharge:[2]

- Any significant reduction in the total mercury concentration in the influent to the City's advanced wastewater treatment plants (AWTs) can only be achieved by initiating a source control program involving non-regulated sources, such as dentists, hospitals, laboratories and domestic sources.[3] Municipal-wide pollution prevention programs can reduce influent levels of total mercury. However, these programs can take a minimum of 5 to 20 years to achieve success (after sources are identified) and require major public outreach and education, complete stakeholder involvement and commitment, and guaranteed sources of funding (in some cases state and federal grants were used for the programs). The City summarized available literature on mercury source studies and pollution prevention program cases in Appendix D of the City's individual variance application. This appendix is also attached to this comment letter for convenience in review.[4]

- Feasible control methodologies capable of attaining the WQBEL were not found. However, a feasible control methodology that could reduce mercury in the City effluent by 50 percent was identified.[5] The overall annualized cost of pollutant removal utilizing the control methodology identified as feasible is $164.9 million per year.[6] The cost effectiveness of adding ion exchange is $5,478,400 per pound of mercury removed.[7]

- There are significant multi-media environmental impacts to adding ion exchange treatment to the City AWTs to further reduce mercury in the wastewater discharge. A brief summary from Section 7 of the individual variance application is provided in this comment letter.

  - Addition of 9,125,000 lb/yr of salt to the White River
  - Solid waste generation requiring 3,800 cubic yards/yr of landfill space
  - Additional use of 52,600,000 kW-hr/yr of electricity
  - As a consequence of the additional power usage, additional emissions of:
    - CO_2: 57,800 tons/yr

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[2] The City's renewed NPDES permits, which IDEM issued on October 26, 2001, and which were to become effective December 1, 2001, have a final total mercury limit of 10 ppt (monthly average) and the historical effluent averages 110 ppt total mercury. These permits currently are under administrative review, and the limits for mercury are stayed during the pendancy of the appeal.

[3] It is estimated that regulated industrial users account for only two percent of the mercury load to the AWTs, as presented in Section 4 of the City's July 2001 individual variance application.

[4] The City would also recommend as references to IDEM "Mercury Source Control and Pollution Prevention Program Evaluation," Association of Metropolitan Sewerage Agencies (under grant from USEPA), March 2002, and "Evaluation of Domestic Sources of Mercury," Association of Metropolitan Sewerage Agencies, August 2002.

[5] The feasible control methodology would be the addition of ion exchange as a tertiary treatment to the City's AWTs. As there is no full-scale use of ion-exchange treatment, the achievable reduction in mercury is based on pilot-scale industrial applications at influent levels well above the AWTs mercury effluent concentrations. Reference Section 6 of the City's July 2001 individual variance application.

[6] Reference Section 8 of the City's July 2001 individual variance application.

[7] Cost effectiveness equals annualized $164.9 million per year/30.1 lbs/yr removed.

- SO_x: 1,368 tons/yr
- NO_x: 106 tons/yr
- Mercury: 10.8 lb/yr

▪ As mercury is a periodic element, it will never be degraded or destroyed. In adding ion exchange treatment of the wastewater, mercury will be shifted from one media, water, (30.1 lb/yr no longer directly discharged to water) to other media, in this case land and air (40.9 lb/yr). The environmental impact of adding ion exchange treatment to reduce mercury at the AWTs is to <u>increase</u> mercury discharged to the environment by 10.8 lb/yr (via additional air emissions).

To reiterate, these findings presented in the City's individual mercury variance application of:

- sources of mercury,
- timing and effectiveness of pollution prevention programs,
- treatment options for mercury,
- impact on City economic resources to implement treatment, and
- impact on the environment in implementation of treatment

<u>are not unique</u> to the City.

All municipalities have unregulated sources of mercury that would require time, funding, and citizen cooperation in controlling. Treatment of mercury, the cost, and multimedia impact on the environment is similar for any wastewater discharge and would only vary as a function of discharge flow. Therefore, municipal dischargers throughout the State will be faced with filing with IDEM individual variance applications from the mercury criteria. The filing of individual variances consumes time and effort by the municipalities. The processing of all the individual variance applications, in a time to be incorporated into renewed permits, would impose and unnecessary and significant burden on IDEM.

The City believes that establishment of a statewide mercury variance would result in a consistent approach in permit conditions regarding mercury and eliminate time and funds spent on preparing and processing individual applications. Other Great Lake states (particularly Ohio and Michigan) have implemented statewide mercury variance programs. Indiana proposed (327 IAC 2-1.6-16) a statewide mercury variance in February 1999 that was based on the Ohio statewide mercury variance rule. The proposed mercury variance program presented:

- the expensive treatment costs and universal finding of undue burden and hardship,
- list of information to be provided by discharger to qualify for the variance,
- permit conditions that could be present in the permit as part of the variance.

The City generally supports the framework of this proposed rule. However, the City would suggest, based on the City's experience in preparing an individual variance application, the following revisions:

- Modification of the long-term average effluent concentration from 12 ppt. Since 1999, valid low-level mercury effluent data has been generated[8] that show a range of total mercury in municipal effluents of 1 to 70 ppt. IDEM should access all available data to establish a reasonable long-term average threshold that would be used to qualify a discharger for application of the statewide mercury variance rule.

- Clarify that a discharger is still able to apply for an individual variance application if qualification for or compliance with the statewide mercury permit conditions does not mesh with site-specific conditions.

- Supplement the Ohio economic impact analysis performed in support of their statewide mercury variance with information specific to Indiana. The City recommends use of their 2001 updated individual variance application. In addition, multi-media impacts should be mentioned.

- IDEM should establish a clearinghouse and reference library to assist municipalities in designing source surveys and pollution prevention programs. IDEM should also assist municipalities in finding funding for pollution prevention programs, conducting community outreach programs, and coordinating mercury reduction within the land, air, water quality, drinking water, and pollution prevention departments of IDEM and with other state and federal agencies.

The City welcomes the opportunity to assist IDEM in developing a statewide mercury variance rule. We encourage IDEM to expedite completion of this rulemaking.

If you have any questions about the information presented in this letter or our individual variance application, or would like additional information, please call Robert J. Masbaum at (317) 237-2319.

Thank you for the opportunity to comment on IDEM's proposed rulemaking to develop statewide variance procedures for the mercury water quality criteria.

Sincerely,

Barbara A. Lawrence

Barbara A. Lawrence
Director

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[8] For example, Maine DEP "Mercury in Wastewater: Discharges to the Waters of the State 1999" and AMSA "Mercury Source Control and Pollution Prevention Program Evaluation," March 2002.

APPENDIX D

SOURCES OF MERCURY IN MUNICIPAL WASTEWATER

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SUMMARY

This appendix presents summaries of several studies conducted on sources of mercury in the influent of POTW's. These studies have shown that in communities with little industry the influent can contain measurable mercury concentrations from a variety of non–industrial sources. Typical residential wastewater contains 100 to 150 ng/L of mercury. A mass balance has shown that of this about 20 ng/L originates from the mercury contained in products used in households, and a large portion of the difference originates from human waste as a result of the mercury amalgam used for dental work. A study on the discharge of mercury from dentists' offices has shown that the typical dentist office discharges about 0.1 to 0.3 grams mercury/dentist/day. Other sources of mercury identified are:

- Hospitals: 0.3 - 5.4 µg/L
- Septage haulers: 60 - 10,000 µg/L
- Laboratories: 0.1 - 5 µg/L
- Medical waste Incinerators: 30 - 230 µg/L

Drinking water typically has only 0.4 to 0.9 ng/L.

Presentation of Reports Reviewed

Review of several documents on the sources of mercury in the influent to municipal wastewater treatment plants has revealed the following:

1. **An Analytical Survey of Nine POTWs from the Great Lakes Basin (draft report December 1994 by Analytical Methods Staff, Office of Science and Technology, Office of Water, USEPA)**

The objective of this study, performed in 1994, was to determine the presence and concentration of Bioaccumulative Compounds of Concern in selected point sources in support of the proposed Water Quality Guidance for the Great Lakes System. Treated effluent samples were collected from nine publicly owned treatment works in the Great Lakes System that provide at least secondary treatment and have industrial users that contribute between 0% and 70% of the total flow.

The effluent data in Table D-1 show that the mean effluent concentration was 11 ng/L and that most of the mercury was in the insoluble form, therefore, directly related to the TSS level in the effluent. Only a very small percentage was present as methyl mercury.

As illustrated in Table D-2, the site characteristics show that the highest mercury concentration was in the effluent with the highest TSS effluent level. The percent industrial contribution to this treatment plant was 0%.

2. **Blueprint for Mercury Elimination (see www.wlssd.duluth.mn.us/blueprint)**

Western Lake Superior Sanitary District (WLSSD) staff began to address mercury issues following reports of high levels of mercury in fish in the St. Louis River in 1989. Initial efforts focused on internal practices, such as scrubber water management, and evolved into a broader examination of mercury contributions from the community at large. Under its current NPDES permit, the WLSSD must meet an effluent mercury limit of 0.03 µg/L (30 ng/L). New regulations adopted under the Great Lakes Water Quality Initiative propose even more stringent water quality criteria for mercury. After evaluating the costs involved to meet the proposed limits with end-of-pipe technology, WLSSD staff concluded that pollution prevention is preferable.

The WLSSD conducted a two-year Mercury Zero Discharge Project to examine the sources of mercury to its wastewater treatment plant and to determine how to reduce or eliminate those sources. This project included cooperative initiatives with industries known to be discharging mercury, programs aimed at specific uses of mercury, a monitoring program to identify additional sources, and a public awareness campaign. WLSSD also examined its own facilities and practices. WLSSD has seen a reduction in mercury concentration in their influent during this project. Refer to Table D-3 for a summary of mercury contributors. The mass balance has identified some of the major sources and are listed in Table D-4. Permitted industries contributed only 8% to the influent mercury concentration.

As a result of in-house process changes and this ongoing public awareness program, WLSSD has seen a reduction of mercury in dry sludge from 4.50 mg/kg in 1990 to 1.50 mg/kg in 1996 (in comparison, Indianapolis has a mercury concentration in the sludge of 0.95 mg/kg). During the same time period, effluent mercury levels decreased from 0.58 µg/L to 0.015 µg/L. (See Table D-5 Mercury Concentration in WLSSD Dry Sludge and Effluent).

The following is a listing of some of the case histories on successful reduction of mercury discharges.

Mercury in Dental Amalgam

Mercury-containing amalgam is used by dentists as a filling material for teeth. Waste amalgam sometimes is disposed of down the drain. In 1993, WLSSD staff sampled the wastewater discharge from a medical building housing several dental practices and found a mercury concentration of 35 µg/L (0.3 gram/dentist/day). WLSSD staff produced a manual of best management practices with information on proper disposal of mercury, amalgam, and other dental office wastes. This manual was distributed to all dentists in the WLSSD service area. Subsequent monitoring of the same building in 1995 found the effluent mercury concentration reduced to 0.086 gram/dentist/day or a 70% reduction.

St. Mary's Medical Center

St. Mary's Medical Center is a 326-bed hospital. A mercury reduction survey on mercury use disclosed that St. Mary's had already replaced some mercury containing items. A wastewater monitoring plan was then developed to try to pinpoint mercury sources within the hospital. Monitoring results found mercury concentration varying from 0.3 µg/L to 1.2 µg/L. At this time, the mercury in the wastewater appears to be coming from the hospital laboratories and laundry services. Reagents and bleach are the suspected sources. These products are being investigated and, where possible, alternatives will be substituted. Historic sources are also under investigation (i.e., broken thermometers are being disposed of into drains). Traps in nursing stations and in the laboratories are being cleaned and inventoried as part of the reduction effort.

Western Lake Superior Sanitary District

WLSSD pollution control equipment includes a wet scrubber that removes particulates, heavy metals, and other pollutants from the incinerator emissions. Prior to 1990, the scrubber water was recirculated back to the head of the plant for treatment, carrying its load of metals with it. This process was modified to separate the scrubber water from the plant influent. Scrubber water is now pretreated and largely contained within a closed loop system, resulting in a reduction in mercury loading to the plant. Improvements in the solid waste processing system implemented in 1995 have resulted in the production of cleaner fuel, with an associated decrease in mercury content. Process chemicals were also sampled for mercury contamination. Mercury concentrations in caustic soda, sulfuric acid, and ferric chloride were found to be as high as 100, 10,000, and 8,000 µg/L, respectively. Pollution prevention measures implemented include educating employees about mercury in the workplace, screening process chemicals for mercury levels, reviewing the chemical purchasing procedure to assure that new chemicals meet specification, and reviewing laboratory procedures to modify those that involve mercury.

3. Evaluation of Domestic Sources of Mercury (Association of Metropolitan Sewerage Agencies, August 2000)

Claims were made that elimination/minimization of mercury from point sources, such as dental facilities and hospitals, would result in "zero discharge," or at least enable POTWs to meet extremely low aquatic life and wildlife water quality criteria for mercury. In fact, in its proposed mixing zone ban for mercury and other bioaccumulative pollutants in the Great Lakes, EPA noted that in several documented instances in the Great Lakes Basin and elsewhere the development and implementation of aggressive source control programs resulted in the virtual elimination of bioaccumulative pollutants. This approach, however, assumes that no background mercury concentration is in domestic wastes. To better understand the relative contributions of mercury in domestic wastes and potential source control options, a study was initiated to collect information on concentrations of mercury in domestic wastewater, to identify the sources of mercury in domestic wastewater, and to evaluate the feasibility of controlling those mercury sources.

Domestic wastewater data were collected by the following four POTWs: the Massachusetts Water Resources Authority (MWRA) in Boston, Massachusetts; the Metropolitan Council Environmental Services (MCES) in St. Paul, Minnesota; the Hampton Roads Sanitation District (HRSD) in Virginia Beach, Virginia; and the City of Palo Alto, California. The sampling locations were carefully screened in all areas to assure that only residential wastewater flows were sampled with no commercial or industrial inputs. Age of the sampled residential service areas ranged from <10 to ~125 years old. The results of this study are presented in Table D-6.

Using all the mercury data, the mean and median values of residential areas were:

Mean	178 ng/L
Median	110 ng/L

The normalized data set with an exclusion of extremely high values, which were considered outliers, provided the following mean and median values:

Mean	138 ng/L
Median	104 ng/L

Using the data sets that included non-detected values at the MDL concentrations resulted in the following mean and median values:

Mean	143 ng/L
Median	88 ng/L

No clear correlation could be established between the age of the collection system/neighborhood and the mercury concentration. Based on the Palo Alto data, population density may have a greater impact on mercury concentrations than the age of the service area.
Some literature sources report commonly used detergents and toiletries as potentially contributing to mercury in residential wastewater. HRSD performed mercury determinations on several common household and toiletry items. See Table D-7 for the range of mercury concentrations in these common household items.

Mass balance calculations were performed using the mercury data for the domestic products evaluated to determine the relative contribution of these products to domestic mercury loadings to POTWs. Results of the calculations can be found in Table D-8. It is interesting to note that fish consumption accounts for 90% of the mercury discharged in this presentation.

To determine the average domestic contribution per household, the sum of the mercury contribution for all of the domestic and food products was divided by the flow for each household.

Total Mercury Contribution =	937,303 ng/month
Average Household Flow =	45,420 L/month
Average Household Contribution =	20.6 ng/L

Approximately 15% of the total domestic contribution can be attributed to food, toiletry, and household products. The typical mercury concentration in residential wastewater is 110 ng/L. Therefore, 85% of the mercury comes from other sources. One explanation is that a significant source of mercury comes from human wastes. For comparison purposes, data were obtained and evaluated for portable toilet wastes, including chemical toilet wastes and septage. The intent of presenting these data is to provide anecdotal support that levels or mercury in human excrement, independent of the contribution from discharged household products, are substantial. Chemical toilet waste samples were collected and analyzed by the Northeast Ohio Regional Sewer District (NEORSD) in Cleveland, Ohio. Because these wastes do not contain household products, the data collected should provide an indication of the fecal/urinary contribution of mercury to domestic wastewater. The mean mercury concentration was 3,700 ng/L while the median concentration was 800 ng/L. Although mercury was detected at 410 ng/L in the chemical treatment solution added to portable toilet waste, the solution volume is very small relative to the total waste volume and cannot account for the total mercury measured in the waste.

NEORSD also collected and analyzed 34 samples from 12 different waste hauler services to determine concentrations of mercury in exclusively domestic septage. The results yielded mean and median mercury concentrations of 12,918 ng/L and 6,950 ng/L.

Information in the literature indicates that after mercury is released from human tissues, fecal excretion becomes the predominant route for elimination of mercury, and that the rate of excretion correlates with the number of amalgam fillings. The release of mercury (Hg) from dental amalgam fillings has been verified by several authors. In this study[1], the emission rate of Hg^0 vapor from the oral cavity (O-Hg) and the urinary Hg-excretion rate (U-Hg) have been studied with 34 healthy individuals. In ten cases, the urinary Hg-excretions of silver (U-Ag) and the fecal excretions of Hg and Ag (F-Hg, F-Ag) were also monitored. All variables, except U-Ag, were significantly related to the load of amalgam. According to this study, an individual with a moderate load of amalgam, i.e., 30 restored surfaces, is predicted to exhibit the following emission rates: O-Hg=22, U-Hg=3, F-Hg=60, and F-Ag-27 µg/d (d=24 hours), consistent with a gross mass balance for Hg of approximately 60 µg/d. The corresponding systemic uptake of Hg was estimated to be 12 µg/d based on external data relating air Hg^0-exposures to urinary Hg-excretions. Therefore, based on this study, humans can be exposed to a total of 145 µg/d of mercury of which 85 µg/d are released, 12 µg/d are taken into the body, and 48 µg/d are body burden (and could be assumed to be from the dental amalgam).

Studies show that the amalgam particles are formed when a person chews aggressively, and the amount of particles originating from fillings can be estimated from a fecal sample, with at least 80% of the ingested particles excreted. It is also shown that mercury vapor dissolved in water and swallowed was only excreted to about 40% in feces. Measurements by Skare have indicated that dental amalgam-loaded individuals excrete mercury at average rates of 64 µg/d in feces and 4.5 µg/d in urine. The control in the study, representing dental amalgam-free individuals, had measured mercury excretion rates of 1 µg/d in feces and 0.4 µg/d in urine. Subtracting the control measurement, the total rate of dental amalgam mercury excreted by the average dental amalgam-loaded individual through feces and urine would be 67 µg/day (67,000 ng/day). Assuming a daily wastewater generation rate of 100 gallons per day per individual (378 L/day; *Sanitation Districts of Los Angeles County, Final Joint Outfall System Master Facilities Plan, June 1995*) and an estimate that 65% of the population has dental amalgam fillings (*September*

[1] Skare, et.al, Mass Balance and Systemic Uptake of Mercury Released from Dental Amalgam Fillings, *Water, Air, and Soil Pollution, 80: 59-67, 1995*

1992 Bio-Probe), a domestic sanitary sewage mercury concentration attributable to excreted dental amalgam mercury is 115.2 ng/L. This should be compared to a mean influent concentration of 138 ng/L for residential wastewater.

Some limited data were available on the levels of mercury in the tributary drinking water sources for the agencies studied using sensitive methods. The data is summarized in Table D-9.

It should be noted that in order to fully characterize drinking water from these areas, multiple sampling events capturing seasonal changes would be required. The range in concentration depends on whether the source is surface water (3- 4 ng/L) for some Great Lakes communities; *Personal communication, Keith Linn, NEORSD*) or ground water (2 ng/L for Wisconsin). In these cases, the relative contribution from drinking water to total wastewater mercury appears to be small (2 to 4%).

4. OHIO EPA (www.epa.state.oh.us/dsw)

Ohio EPA has issued a few reports on mercury in municipal wastewater. They list, as a typical influent concentration, a range of 70 to 120 ng/L, while typical effluent concentrations are in the range of 1 to 13 ng/L. Attachment 2 of the Ohio Mercury Variance Guidance presents a listing of mercury sources in municipal wastewater. This attachment is summarized in Table D-10. The Ohio Great Lakes Initiative Pollution Prevention Guidance presents a listing of sources of mercury and has a list of useful references for further study on this topic.

5. MWRA/ MASCO Study (Mercury Management Subcommittee, December 1997, Boston)

Typical concentrations for identified point sources of mercury were:

• Clinical laboratories	1 - 4 µg/L
• Medical Waste Incinerators	30 - 230 µg/L
• Hospital Laundry facilities	0.1 - 1.6 µg/L
• Other related facilities (laboratories)	0.2 - 1.5 µg/L
• Medical and Biotech Research Facilities	1 - 3 µg/L

Total mass load from these 5 sources to the MWRA treatment plant is between 0.028 and 0.042 lb/day. Total load of mercury to headworks is 0.77 to 0.83 lb/day. At a total flow of about 400 mgd the concentration in the influent is then about 240 ng/L.

6. Supplemental Manual on the Development of Local Discharge limitations (EPA 21-W4002, May 1991)

The average influent mercury concentration in residential wastewater is 2 µg/L with a maximum of 54 µg/L and a minimum of <0.1 µg/L.

TABLE D-1. EFFLUENT DATA 9 POTWs IN GREAT LAKES REGION
(Source: USEPA, 1994, An analytical survey of nine POTWs from the Great Lake Basin)

Analyte	1994 Hg/MMHg Effluent Concentration (ng/L or ppt)				
	Min	Max	Mean	MDL	#
Hg, Total	2.72	36.16	11.24	0.24	5
Hg, Diss	3.13	3.48	3.31	0.24	2
MMHg, Total	0.05	0.71	0.16	0.018	9
MMHg, Diss	0.06	0.36	0.14	0.018	8

Notes:
# Frequency of occurrence of analytes detected at concentrations greater than or equal to the detection limit of the analytical method used.
MMHg = Mono Methylmercury
Diss = Dissolved (sample filtered through 0.45 μm filter).
ppt = parts per trillion = ng/L.

TABLE D-2. SITE CHARACTERISTICS OF 9 POTWs IN GREAT LAKES REGION
(Source: USEPA, 1994, An analytical survey of nine POTWs from the Great Lake Basin)

Site No.	Industrial Contribution (%)	Avg WW Flow Rate (mgd)	Level of TSS in Effluent (mg/L)	Concentration of mercury Effluent (ng/L)
1	0	0.5	23.0	36.0
2	40	52	21.0	8.3
3	25	1	8.5	4.8
4	35	1.5	5.0	ND
5	15	1	3.5	ND
6	70	13.5	12.0	4.2
7	20	4.5	2.0	ND
8	15	2.4	9.0	ND
9	20	134	8.0	2.7

Notes:
WW = Wastewater
ng/L = 0.001 μg/L or 0.000001 mg/L
ND = non-detect at 0.24 ng/L

TABLE D-3. SOURCES OF MERCURY (WLSSD report)
(Source: WLSSD, 2001,
Blueprint for Mercury Elimination)

Contributors Of Mercury to Wastewater
Batteries
Fluorescent Light Tubes
Thermostats
Thermometers
Barometers
Manometers
Vacuum Gauges
Switches
Relays
Sensors
Dental Amalgam
Pigments
Laboratory Process
Pesticides
Pharmaceuticals
Preservatives
Hospitals
Dentists
Sewer Cleaning Practices
Septic Haulers
Residential Wastewater
Veterinary Clinics
Printing Industry
Pottery and Arts
Automobile Service
Painting and Paint Stripping
Scrap Dealers
Landfill Leachate
Pollution Control Devices

WLSSD = Western Lake Superior Sanitary District

TABLE D-4. BLUEPRINT FOR MERCURY ELIMINATION: SUMMARY
(Source: WLSSD, 2001, Blueprint for Mercury Elimination)

WLSSD Wastewater Hg sources Sector	 % Contribution
Permitted Industries	8
Residential	14
Surveyed Business	44
Unknown	34
Note: Surveyed business includes hospitals, dentists, universities, etc.	
Analyzed	**ppb (µg/L)**
Septic Haulers	62
Residential	0.1
Pottery	0.31
Paint stripping, new	250
Paint stripping, old	125,000
Landfill leachate	0.7 - 2.0
Hospitals	0.3-5.4
Industrial laundry	0.7
	grams/dentist/day
Dentists	0.1-0.3

TABLE D-5. MERCURY CONCENTRATION IN WLSSD DRY SLUDGE AND EFFLUENT
(Source: WLSSD, 2001, Blueprint for Mercury Elimination)

Year	Dry Sludge (ppm)	Effluent (ppb)
1990	4.5	0.58
1996	1.15	0.015

ppb = µg/L = 1,000 ng/L

TABLE D-6. SUMMARY OF MERCURY CONCENTRATIONS FOR ALL SERVICE AREAS
(Source: AMSA, 2000, Evaluation of Domestic Sources of Mercury)

Service Area	No. of Samples	Dates of Sampling	Age of Area	Average Hg All Data (ng/L)	Average Hg Excluding outliers (ng/L)	Average Hg NDs at MDL (ng/L)	Avg TSS (mg/L)
MCES							
Colby Lake	7	11/97, 4/98	NA	61	61	69	NA
Weir Drive	9	11/97, 4/98	NA	32	32	35	NA
Juliet St.	6	11/97, 4/98	NA	51	51	46	NA
Lilac-Men. Heights	5	6/98	NA	239	239	239	NA
Navajo-MH	6	6/98	NA	53	53	53	NA
So. St. Paul	6	6/98	NA	70	70	70	NA
MWRA							
DEDH	63	1/96 - 1/99	36	157	110	1226	NA
WALT	63	1/96 - 1/99	26	149	110	139	NA
WEYM	63	1/96 - 1/99	47	102	102	122	NA
WINC	63	1/96 - 1/99	12 - 124	89	79	110	NA
HRSD							
Courthouse Estates	1	3/12/99	< 10	17	17	17	143
Lago Mar	1	3/12/99	15	31	31	31	58
Hunt Club	1	3/12/99	15	86	86	86	245
Monroe Place	1	3/12/99	60	47	47	47	69
Elnhurst	1	3/12/99	50	284	284	284	176
Powhatan	1	3/12/99	50	58	58	58	120
Palo Alto							
Pulgas (mainly apts)	45	5/95 - 2/99	37	292	172	192	NA
Waverly (upscale houses)	41	5/95 - 2/99	37	165	149	193	NA
Mean				**178**	**138**	**143**	
Median				**110**	**104**	**88**	
St. dev.				**86**	**72**	**275**	

TABLE D-7. EVALUATION OF DOMESTIC SOURCES OF MERCURY (AMSA 2000): SUMMARY

(Source: AMSA, 2000, Evaluation of Domestic Sources of Mercury)

Mercury in Common Household Products and Toiletries

Product Type	# of Products Tested	Range of Concentration (ppt)	
		Minimum	Maximum
Toothpaste	5	490	3,800
Shaving Cream	4	90	670
Deodorant/Antiperspirant	2	1,010	1,350
Soap/Shampoo	5	835	25,000
Toilet Tissue	3	220	1,510
Laundry Detergent	6	560	2,490
Bleach	2	< 200	6,170
Dish/Dishwashing Detergent	4	560	1,320
Drain Cleaners	2	2,970	5,490
Soft Drinks/Drink Mixes*	3	25	6,070
Fruit Juices	3	789	3,560
Fruit/Vegetables**	4	116	874
Rice/Grains	2	26	< 200
Processed Meats	6	< 100	290
Beef/Chicken	2	29	< 40
Condiments***	4	133	1,956
Food Coloring ****	4	96	137,000

Notes:

* With yellow or red dyes

** Fresh, frozen and canned

*** Salt and sugar

TABLE D-8. MASS BALANCE FOR DOMESTIC SOURCES OF MERCURY
(Source: AMSA, 2000, Evaluation of Domestic Sources of Mercury)

Product	Usage per Month (kg/month)	Avg. Hg Conc. (ng/kg)	Hg Household Contribution (ng/month)
Shaving Cream	0.24	340	82
Deordorant	0.06	1180	71
Soap	0.12	7908	949
Shampoo	2.04	835	1,703
Toothpaste	0.42	1230	517
Mouthwash	0.91	15	14
Dishwashing Detergent	0.91	1320	1,201
Dishwasher Detergent	2	1478	2,956
Laundry Detergent	4	1478	5,912
Bleach	0.9	6170	5,553
Toilet Paper	1	827	827
Drain Cleaners	0.18	4230	761
Soft Drinks			
Powdered Mix	0.14	6070	850
Premixed	5.52	25.1	139
Carbonated	8.16	142	1,159
Fruit Juices	14.7	2570	37,779
Rice/Grains	33.6	26.4	887
Hot Dogs/Sausage	3.64	100	364
Processed Lunch Meat	1.82	200	364
Fish and Shellfish*			852,000
Ground Beef, Chicken	7.23	30	217
Fresh, Frozen and Canned			
Vegetable and Fruit	27.6	400	11,040
Sugar**	6	1602	9,612
Salt**	1.2	1,956	2,347
Total All Products			**937,303**

Notes:
* Monthly consumption in a four person household.
** Includes quantities found in prepared foods.

TABLE D-9. SUMMARY OF MERCURY LEVELS IN TRIBUTARY DRINKING WATER SOURCES
(Source: AMSA, 2000, Evaluation of Domestic Sources of Mercury)

Date	Service Area	No of Samples	Avg Conc (ng/L)
Not Listed	HRSD	5	0.7
3/00	Minneapolis	8	0.4
3/99 - 4/00	Palo Alto	12	0.9

TABLE D-10. DOCUMENTED SOURCES OF MERCURY
(Source: Ohio EPA, website, Mercury Variance Report)

Contributors	Mode	Concentrations
Common Contributors		
Hospitals	Breakage of mercury containing equipment, laboratory reagents, mercuric oxide batteries	0.3 - 5.4 ppb*
Dentists	Dental amalgam. (Some of this mercury may be transformed into bioavailable form during wastewater treatment. Majority will concentrate in sludge.	0.1 - 0.3 gram/dentists/day*
Sewer Cleaning	Mercury collects in sewer line sediments. Sewer cleaning flushes sediments to the wastewater treatment plant.	NA
Residential Wastewater	Mercury ingested deposited in human waste.	0.1 ppb average*
Septic Haulers	NA	62 ppb average. For sanitary sewer district 1.6% of influent mercury was calculated to be from septage. *
Unique Contributors		
Industrial Laundries	Chemicals used in cleaning process such as bleach and caustic soda, dirt cleaned from clothing. Imported clothing may contain mercury in dyes and preservatives.	0.7 ppb *
Laboratories	Mercury containing equipment and reagents.	5 ppb
Veterinary Clinics	Mercury containing devices and reagents	NA
Printing Industry	Inks and special paper coatings	NA
Pottery and Arts	Mercury contained in pigments in art materials	0.31 ppb. Individual glazes had concentrations up to 41 ppb. *
Automobile Service	Mercury in oil and dirt.	NA
Painting/Paint Stripping	The use of mercury in latex paint has been banned since 1990. Latex paint manufactured prior to that date could contain mercury. Stripping of old paint from houses may result in introduction of mercury into sewers. Storage of old paint.	250 - 125,000 ppb in old latex paint. (pre 1990)*
Scrap Dealers	Vehicles and domestic appliances containing mercury such as gauges and light fixtures	NA
Unique Contributors		
Landfill Leachate	Leachate will vary greatly dependent upon the type of waste at the landfill	Municipal solid waste facility 0.7 - 2.0 ppb.*
Pollution Control Devices	Wet scrubbers at industrial facilities where there is no pretreatment for the scrubber water before being discharged to the sewer.	200 ppb prior to treatment, 20 ppb after treatment.

Note:
* All data provided here was obtained from a literature review and investigations conducted by the Western Lakes Superior